Do polyamines increase the antioxidant capacity of hyperhydric shoots ?

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Hyperhydricity is a physiological disorder affecting shoots vegetatively propagated *in vitro*. Hyperhydric shoots are characterized by a translucent aspect due to a chlorophyll deficiency, a poorly developed cell wall and higher water content. Hyperhydricity generates a deviation of nitrogen metabolism in favour of polyamines and proline which contributes to decrease the stress response of hyperhydric shoots (Franck et al. 2001). Hyperhydricity of apple Jonagold shoots was expressed *in vitro* in one multiplication cycle by replacing the gelling agent agar (normal shoots, NS) by gelrite (hyperhydric shoots, HS). After 28 days of culture on gelrite, there is a significant increase of the number of hyperhydric leaves of apple shoots in comparison to normal shoots. In both cultured conditions (agar and gelrite), we observed a decrease of the antioxidant capacity toward the middle cycle of culture (14 days) then a recovery in shoots cultured on agar but not on gelrite. The aim of this work was also to study the effect of the exogenous addition of a polyamine, spermidine (Spd) or putrescine (Put) or a precursor of polyamines biosynthesis such as ornithine (Orn) or arginine (Arg) on hyperhydricity. The effect of the tested substances was evaluated after 1 culture cycle of 28 days by measuring the number of normal and hyperhydric leaves. In addition, the antioxidant capacity of the shoot extracts was evaluated by measuring their total polyphenol content and their ability to inhibit radical species formation by DPPH and ORAC techniques. The addition of Orn, Arg, Put or Spd into the medium with gelrite decreased the formation of hyperhydric leaves, but this effect was mostly observed for treated shoots with Arg or Spd. Interestingly, the presence of Arg or Spd also increased the antioxidant capacity of the shoots cultured on gelrite. These results suggest that the exogenous addition of Arg or Spd has a protective effect against the stress response of hyperhydricity.